Development and Implementation of Mobility-as-a-Service - A Qualitative Study of Barriers and Enabling Factors

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Development and implementation of Mobility-as-a-Service – A qualitative study of barriers and enabling factors

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ABSTRACT

Mobility-as-a-Service (MaaS) has been argued as part of the solution to prevalent transport problems. However, progress from pilots to large-scale implementation has hitherto been slow. The aim of the research reported in this paper was to empirically and in-depth investigate how, and to what extent, different factors affect the development and implementation of MaaS. A framework was developed, with a basis in institutional theory and the postulation that formal as well informal factors on different analytical levels (macro, meso and micro) must be considered. The research was organised as a multiple case study in Finland and Sweden and a qualitative approach was chosen for data collection and analysis. A number of factors with a claimed impact on the development and implementation of MaaS was revealed. At the macro level, these factors included legislation concerning transport, innovation and public administration, and the presence (or not) of a shared vision for MaaS. At the meso level, (the lack of) appropriate business models, cultures of collaboration, and assumed roles and responsibilities within the MaaS ecosystem were identified as significant factors. At the micro level, people's attitudes and habits were recognised as important factors to be considered. However, how the 'S' in MaaS fits (or not) the transport needs of the individual/household appears to play a more important role in adoption or rejection of MaaS than what has often been acknowledged in previous papers on MaaS. The findings presented in this paper provide several implications for public and private sector actors. Law-making authorities can facilitate MaaS developments by adjusting relevant regulations and policies such as transport-related subsidies, taxation policies and the definition of public transport. Regional and local authorities could additionally contribute to creating conducive conditions for MaaS by, for example, planning urban designs and transport infrastructures to support service-based travelling. Moreover, private actors have key roles to play in future MaaS developments, as both public and private transport services are needed if MaaS is to become a viable alternative to privately owned cars. Thus, the advance of MaaS business models that benefit all involved actors is vital for the prosperity of the emerging MaaS ecosystem.

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1. Introduction

As an increasing population travels to work, school, and leisure activities, the need for urban and sub-urban transportation is predicted to continue to rise, resulting in an even further increase in emissions, noise, congestion and in overloaded infrastructures. For decades, different more or less successful schemes have been implemented in order to support a shift from less to more sustainable travel including for example economic and legal measures (e.g. congestion charging), awareness campaigns, ICT-based information services (e.g. travel planners, real-time information), as well as the development of physical infrastructure (e.g. cycle paths). Along with societal trends such as digitalisation, servicification, and the sharing economy, Mobility-as-a-Service (MaaS) – i.e. a service that integrates different mobility services (e.g. public transport, car sharing, bike sharing, taxi, etc.) and provides one-stop access to these services through a common interface – is being explored as part of the solution. Nevertheless, even though some examples of MaaS exist and a few MaaS pilots have been run with overall positive outcomes (see e.g. Karlsson et al., 2016), progress from pilots to large-scale implementation has hitherto been fairly slow. Thus, there still largely remains a lack of empirical evidence as to whether or not MaaS can live up to expectations.

The reasons for this lack of large-scale take off are multi-facetted. Previously highlighted barriers include legislation and regulatory frameworks (Konig et al., 2016a; Trafikanalys, 2016), taxation (Trafikanalys, 2016), lack of funding (Konig et al., 2016a), lack of appropriate business models (Catapult, 2016; Konig et al., 2016a; Li and Voege, 2017), uncertainties regarding market potential (UITP, 2014; Kamargianni et al., 2015), and a lack of cooperation between key stakeholders (Konig et al., 2016a; van Audenhove et al., 2014). However, albeit in agreement, these suggested obstacles are predominantly based on expert opinions and/or surveys to stakeholders with only very limited or no experience of or involvement in actual MaaS development and implementation processes. Hence, there is a lack of information from actors with such experience.

This paper is based on a comparative, empirical, in-depth qualitative analysis of *institutional factors* – actual and perceived – affecting the development and implementation of MaaS. Assuming that MaaS is as a concept worthy of pursuit, not least in order to provide empirical evidence as to whether or not it can indeed contribute to sustainable mobility, the ultimate purpose of this study was to provide suggestions as to how conditions can be modified to enable MaaS in general, and MaaS that contributes to sustainable mobility in particular. To that end, an analytical framework was developed and applied.

2. Analytical framework

The analytical framework described aims at identifying, organising and interpreting the empirical data in a systematic and transparent way that is also broad enough to capture significant elements characteristic of MaaS (see also Mukhtar-Landgren et al., 2016). Additionally, in drawing upon institutional theory – advanced to understand and explain organisational as well as individual action (Dacin et al., 2002) – in the development and application of the framework, this paper also contributes to the analysis of institutional aspects of transport policy (e.g. Paulsson et al., 2018).

Institutions are defined as a collection of relatively stable rules and practices, “embedded in structures that make action possible” (March and Olsen, 1989:39). These include what is here referred to as *formal* institutions, such as laws, regulations, plans and planning processes, as well as *informal* institutions, including identities, norms, perceptions, daily habits and practices (cf. March and Olsen, 2008; Mukhtar-Landgren et al., 2016). Institutions enable and/or constrain actors involved in policy processes (Mukhtar-Landgren et al., 2016; Jacobsson et al., 2015), including, as in the case of MaaS, processes of initiating new ventures. When innovations or new ideas are introduced, institutions can adapt to changes in their environment, but institutional actors may well choose types of reforms that make innovations ‘fit’ into the existing institutional context (Hall, 2012; Scott, 2014). In other words, action is possible but conditioned and sometimes even constrained by the institutional environments.

The framework further assumes that the identification of institutional barriers and enablers must consider different levels of analysis – macro, meso and micro – each of which encompasses formal as well as informal dimensions. The *macro level* embraces broader societal and political factors. Here formal factors include legislation but also other policy instruments such as taxation, subsidies and organizing capacities. The macro level also encompasses informal societal aspects, including culture, norms and political visions. An explicit governmental ambition to promote innovation or sustainability can for example enable development through measures of political and/or societal support. In this context, it is also important to keep in mind that transport policy processes are characterised by potential conflicts of interest and power relations (cf. Hultén, 2012), such that priorities, as well as norms, are contested and negotiated on all levels.

The *meso level* is comprised of private actors as well as various formal organisations operating under different jurisdictions ranging from regional public transport authorities to municipal planning departments (including the organisations’ separate democratic, decision-making bodies). In regard to formal factors, regional and local governments impact the conditions for MaaS through for example economic and regulative incentives such as public transport subsidies or parking regulations. There also exist informal factors such as organizational cultures, inherited inter- and intra-organizational networks between regional and local actors, and the ways that new collaboration and partnerships are established among actors that have not previously worked together. While collaboration is a key feature in the field of (public) transport (Paulsson, 2018; Pettersson and Hrelia, 2018), there also exist coordination problems within and between local and regional actors (e.g. Duffhues and Bertolini, 2016; Paulsson et al., 2018; Frisk and Pettersson, 2016). In the case of MaaS, each actor enters the collaborative process with their own previous experience, as well as their own ideals, interests and expectations. It is in the complex negotiation process that the framework takes it point of departure. It is also in this context that business models will be developed, another central aspect of the realisation of MaaS.

Finally, the framework includes a *micro level*, where an individual perspective is at centre stage. From an institutional perspective,

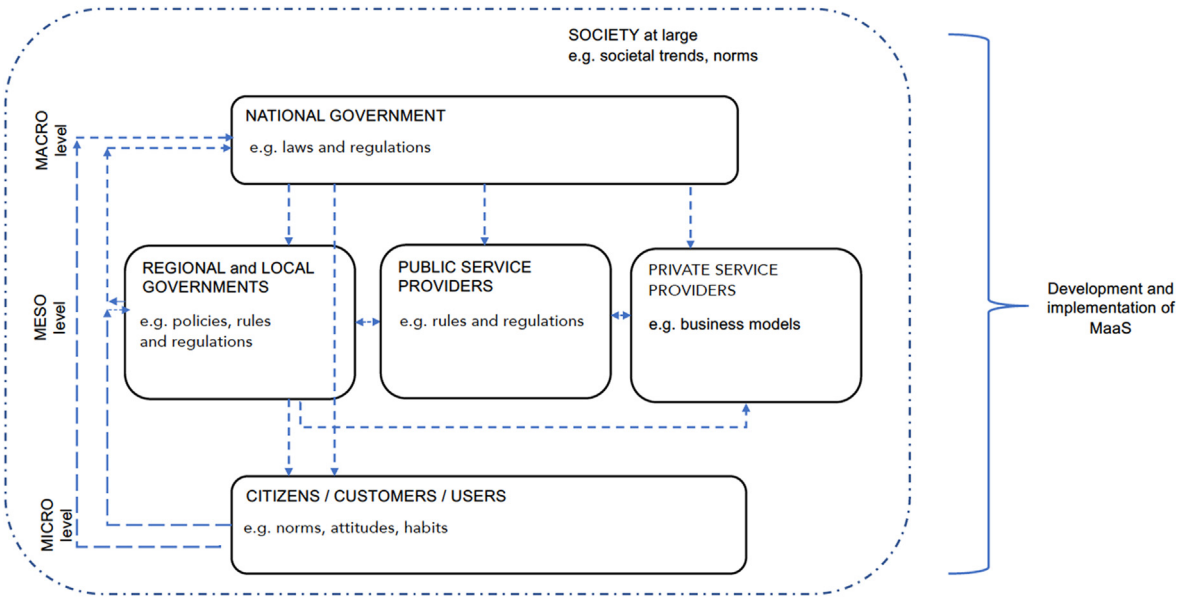

Fig. 1. The basis for the analytical framework, dotted lines indicating assumed (inter)dependencies between levels and actors.

the micro level describes the individual as a citizen with democratic rights; a taxpayer (e.g. through her contribution to subsidised public transport); and (primarily) as a potential customer and user of MaaS. Individuals are affected by various formal push and/or pull incentives, such as congestion charges or subsidies that specifically target travel behaviour. However, and perhaps in particular more informal aspects, such as norms (e.g. Verplanken et al., 1998), self-image and the status of different modes of transport (e.g. Steg, 2005), and attitudes (e.g. Anable, 2005) have been found to impact the individual's choice of transport mode and travel behaviour.

The main components of the framework are brought together in Fig. 1.

3. Method

3.1. Research design

As MaaS is an emerging phenomenon and the study was of an explorative nature, the research was organised as a multiple case study with a qualitative research design. Multiple case studies are considered relevant for exploring new phenomena in depth and for creating high-quality explanatory theories (Baxter and Jack, 2008; Dyer and Wilkins, 1991; Eisenhardt, 1989). The qualitative approach was considered appropriate in relation to the ambition to collect in-depth and explanatory information of formal but also informal factors.

The multiple case study encompassed four distinct cases of MaaS developments – three in Sweden and one in Finland, two countries that have acted as MaaS pioneers (cf. Mukhtar-Landgren and Smith, 2019). The set of cases was deemed fitting for addressing the aim of the study for three main reasons. First, all the cases encompassed *real* and tangible MaaS action, i.e. the use of actual services by actual users in actual transport contexts was either planned, undergone or currently running (in contrast to e.g. stated preference studies with presumptive users). Thus, it was possible to observe actual relations between institutional factors and MaaS developments. Second, the set of cases displayed a suitable level of variance. For instance, the cases represented different phases in the development and implementation process of MaaS at the time of data collection, in that services were in an initiation stage, in an implementation stage, or had been/were running. Third, the Nordic countries are comparable in relation to both institutional and sector-specific features. In regard to political systems, they are both unitary states with a broad discretionary authority for local governments (Baldersheim and Ståhlberg, 2010). In relation to infrastructure and public transport, both countries have for example wide ranging railway systems, unsubsidised long-distance trains and buses, as well as subsidised local and regional PT. Nevertheless, to some extent the cases also exemplified different national and regional contexts with possible differences in the formation of formal and informal institutions. As a consequence, it was possible to compare the impact of institutions on MaaS developments both between different stages of MaaS development as well as across different institutional settings.

To retain the integrity of each case, data was collected and analysed separately, prior to a final 'case-based' cross-case analysis (cf. Byrne, 2009). The cross-case analysis followed a case-oriented methodology (cf. Khan and van Wynsberghe, 2008) and was performed in a more holistic manner than commonly done in conventional reductionistic approaches to research synthesis (cf. Yin, 2018). In other words, the analysis strived towards preserving the essence of each case and learning from their differences as well as from their similarities (cf. Stake, 2013). Therefore, patterns regarding verbalised barriers and enabling factors were first identified *within* each case and then repetitions *across* the cases were searched for. More specifically, the cross-case analysis was performed in

two steps. First, initial lists of institutional drivers and barriers were developed for each case by the authors directly involved in each data collection (cf. next section). Second, the framework was applied to sort and compare these results. From this second exercise, which was jointly performed by all the authors, a matrix was generated describing similarities and differences across the cases in terms of institutional arrangements on the macro, meso and micro level, respectively. This matrix informed the findings presented in this paper.

3.2. Case studies and data collection

Case 1 – The first case focused on the well-known and well-studied UbiGo pilot in Gothenburg, Sweden. In the pilot, known as Go:Smart, 83 households tried out a MaaS service – UbiGo – that offered access to public transport, taxi, rental cars, car- and bikesharing during a six-month period. Two of the authors (first and last) were (together with H. Strömberg) responsible for the evaluation of field test. Data was primarily collected by means of questionnaires (before, during, and after the test) and interviews and focus groups (after the test). The basis for this paper was a second analysis of individual interviews (n = 20) and three complementary focus groups (n = 10) with test participants, as well as a new analysis of interviews conducted with individuals who had indicated an interest in becoming UbiGo customers but who decided not to join (n = 20). The UbiGo case was hence the only case that provided primary data from users/customers. In addition, the first author completed four personal interviews with individuals representing the service providers and other key stakeholders in the development of the service.

Case 2 – The second case focused on an attempt to procure MaaS in the region of Västra Götaland in Sweden. Following the success of the UbiGo pilot, the regional public transport authority (PTA) decided to procure a regional MaaS service. To improve their knowledge on appropriate procurement terms, the PTA initiated a request for information (RFI) process, which included 28 individual meetings with potential bidders. In the end, based on input from the potential bidders, the PTA decided to change its development path and cancelled the procurement process. The third author observed 24 of the individual meetings as an active participant (cf. Baker, 2006). Furthermore, just after the individual meetings but prior to the PTA's decision to change path, the same author conducted 19 semi-structured interviews with purposefully selected representatives of the PTA and of the potential bidders.

Case 3 – The third case focused on the attempt to implement a MaaS service, known as EC2B, in the Malmö/Lund region in Sweden. EC2B is based on the idea that the need for parking in connection to housing can be reduced if the residents are provided access to a MaaS service. To test this assumption, the initiators of EC2B (a consultancy firm) planned to test a housing-based MaaS service with the residents of two rental complexes in Malmö/Lund that were being built (with low numbers of parking spaces) at the point of data collection. Data was collected through individual interviews (n = 8) with representatives of the initiators of EC2B and of other stakeholders involved in EC2B's potential implementation in Malmö/Lund. These interviews were conducted by the second and fourth authors of this paper who were not involved in the service development. The sixth author, who was involved in the setup and planning of EC2B, provided additional insights.

Case 4 – The fourth case was slightly broader, compared to the other cases. It focused on the developments of MaaS in Finland as a whole. Consequently, it encompassed the Finnish government's actions to facilitate MaaS developments as well as the MaaS trials of Whim, Tuup, Sonnera Reisu and Kätävä, among other things. The second and third authors performed interviews with involved stakeholders (9 individual interviews and 3 group interviews). Additionally, the same authors also reviewed MaaS-related policy documents issued by public organizations in Finland as well as in Sweden.

An overview of the four cases, data collection, stakeholders, etc., and additional related reading are found in Table 1.

4. Findings

The analysis of the data revealed a number of factors with a claimed impact on the development and implementation of MaaS (see Fig. 2). The findings are illustrated by excerpts from the interviews, coded according to the following: I = Informant; SE = Sweden; FI = Finland; Public sector = governmental body/municipality/public transport; Private sector = private company/service provider; User/customer = potential or actual user/customer of MaaS.

4.1. Macro level

In accordance with the framework, the macro level is the umbrella under which the meso and micro levels operate. It provides the legal structure for municipalities and cities but also encompasses informal factors, such as national goals and visions, which can affect the development of MaaS.

Legislation has been argued to hinder innovation and renewal in the transport sector (e.g. Trafikanalys, 2016), an argument that has also been forwarded in regard to the development and dissemination of MaaS (König et al., 2016b). The interviews revealed different concerns related to regulations, although there were notable differences in how these were perceived between public and private actors as well as between Swedish and Finnish informants. In the Swedish interviews, the private service providers primarily mentioned taxation as a barrier, arguing that taxation laws have not (yet) accommodated the ideas of a sharing economy. Moreover, varying value-added tax levels in relation to types of mobility services were considered to create unfair conditions for different actors within the MaaS ecosystem. For the public sector informants, it was instead other laws and regulations that caused concerns, such as the Swedish Public Transport Act. This act defines what public transport is, but in a sense, MaaS calls into question the whole idea of public transport, what it is and what it could be; at the same time, public transport is an essential part of any MaaS ecosystem. In this regard, informants expressed their apprehension regarding which role public transport would be allowed to take within a MaaS

Table 1
Summary of cases and data collection.

	Geographical context	Focus	Development phase	Data collection	Stakeholders involved	Further reading
Case 1	Gothenburg, Sweden	The UbiGo pilot	Completed pilot	Individual interviews (n = 44); Focus groups (n = 10)	Private actors (MaaS operator, transport service providers); Public actors; (regional PTA, municipality) Customers/users	Karlsson et al. (2016), Sochor et al. (2014), Sochor et al. (2015), Sochor et al. (2016), Strömberg et al. (2018)
Case 2	Region of Västra Götaland, Sweden	An attempt to procure a MaaS service for the Västra Götaland County	Initiation	Individual interviews (n = 19); Participatory observations	Public actors (regional PTA); Private actors (potential bidders)	Mukhtar-Landgren and Smith (2019), Smith et al. (2017, 2018a, 2018b, 2019a, 2019b)
Case 3	Malmö/Lund region, Sweden	The process of trying to implement EC2B in Malmö/Lund	Initiation	Individual interviews (n = 8)	Public actors (regional PTA, municipalities); Private actor (MaaS operator)	–
Case 4	Finland	MaaS developments, including legislative reform and MaaS pilots	Initiation, implementation, completed pilots	Individual interviews (n = 9); Group interviews (n = 3); Review of policy documents	Public actors (national government, PTA, municipality, etc.) Private actors (MaaS operators)	Mukhtar-Landgren and Smith (2019), Smith et al. (2018, 2019)

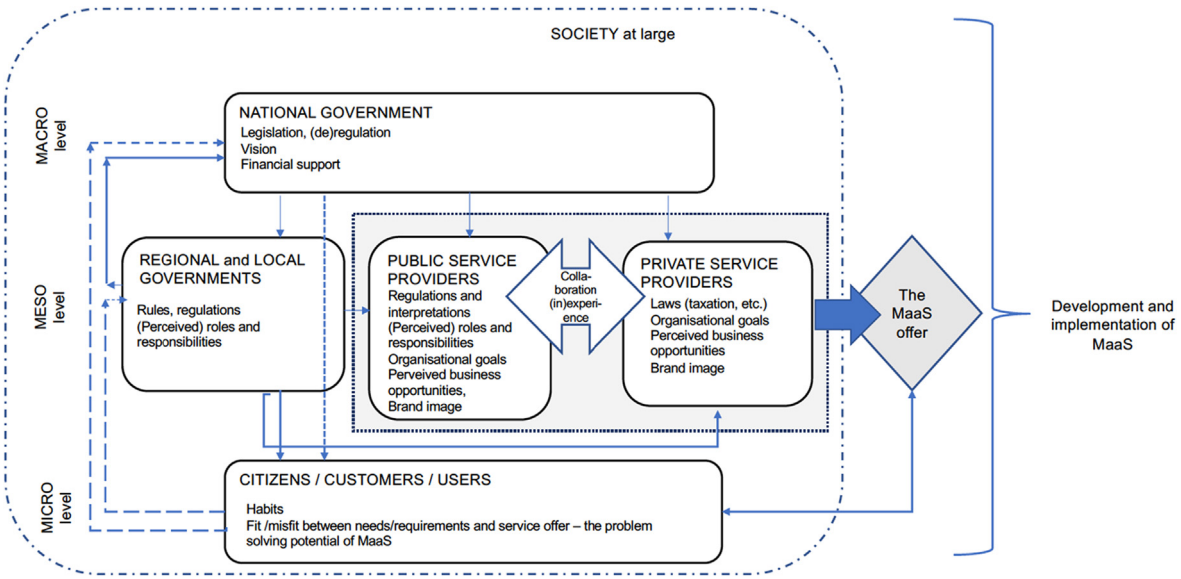

Fig. 2. An overview of factors with a claimed impact on the development and implementation of MaaS. The dotted lines indicate assumed (inter) dependencies although not confirmed in the empirical study.

ecosystem that includes both subsidised and commercial services.

> "The law states that we should not deal with anything but public transport. But where should one draw the line, what is [and what is not] public transport? We are in part financed by taxes, and one cannot do whatever with taxpayers' money, can one?" (ISE4 – public sector)

Another example of hampering legislation forwarded in Swedish interviews was regulations pertaining to competition law (State aid and public procurement), one explanation being that a public transport authority cannot cooperate with specific private firms without procurement, as public actors are not allowed to restrict or distort market competition. It is worth noting how the formal and informal aspects of institutions interact, as even though these laws may well create formal barriers, the interviews also revealed informants' uncertainty regarding how to interpret them. This interplay between formal and informal aspects was also discernible in the diverging perceptions of the role and responsibilities of public transport. Here, the interviews revealed that understandings of the role of subsidised public transport not only varied between private and public actors, but also between and within different public actors.

In comparison, the Finnish informants also spoke of legislation but rather differently than the Swedish informants. Finland had, at the time of the interviews, been taking proactive steps to propose regulations and deregulations that were perceived as necessary to promote the development of MaaS, such as compelling public transport organisations to make single public transport tickets available for resale.

> "The development of MaaS was first. But, legislation has to follow quite soon. … //… Oh! This is something we should push, and we should do something about this – because the legislation process is always very long." (IFI1 – public sector)

In tandem with formal processes of change – and perhaps more importantly – the analysis identified a shared vision at the macro level which could be decisive for MaaS development in Finland, as pinpointed by one of Finnish informants:

> "I think that we in Finland, we have the same vision at the political level and at the public level and at the service providers' level. I think we have the same vision which is a good thing. It is a good start." (IFI1 – public sector)

This sentiment was echoed by other Finnish informants who pointed to a shared vision for MaaS and stressed its enabling function for the developments in Finland, emphasizing its potential in terms of both innovation and transport. We know from policy research that a political will connected to a strong vision and ambition to facilitate change have been identified as decisive enablers for any policy development. It can even be a 'window of opportunity' for policies to emerge and take more practical forms (e.g. Kingdon, 2003). In our interpretation, the shared vision in Finland enabled not only public actors in terms of alignment with over-arching policy goals, but also private actors in terms of a sense of informal support from the government to continue facilitating the development of MaaS. In contrast, none of the Swedish informants mentioned any macro-level vision. Recently, however, initiatives have been taken and a national roadmap for MaaS has been formulated (see https://kompis.me/fardplan). A roadmap is a softer steering instrument than formal rules, but it contains a vision or goals and some of the major steps to reach these goals, while still leaving room for specific action as well as interpretation.

Thus, informal aspects such as visions at the macro level can have relevance for MaaS, but a question is then how such enabling

visions emerge? In the Finnish case and according to the informants, the vision was shaped and anchored through both formal and informal meetings between different public and private stakeholders. These on-going, meso-level collaborative efforts resulted in the creation of enabling preconditions for MaaS through de-regulation and specific regulations as mentioned earlier. In addition, the commitment was formalised with financial support via the Finnish Funding Agency for Technology and Innovation (TEKES) which could then solicit calls for funding:

"… the purpose of the call was simply to spur actors, typical start-up companies, to begin offering MaaS." (IFI3 – public sector)

In the current Swedish context and in relation to the national roadmap for MaaS, funds have been made available for initiating different pilots, the first to take place in 2018–2019. Financing provided by public innovation agencies to start up pilots (one approach often used in Sweden) has been noted as one way to generate innovation and support experimentation while connecting national objectives and visions with small-scale, often locally based, activities (Mukhtar-Landgren et al., 2019).

4.2. Meso level

Meso-level actors include different private as well as public organisations on a regional and local level, each of which have different organisational forms (cf. Hrelja et al., 2017: 613). The interviews with the meso-level actors revealed a number of factors which have been organized into two broad – and very interrelated - categories: (i) those relating to perceived *uncertainties* surrounding roles and mandates, business models and proof of concept, and (ii) those relating to *cooperation* and *collaboration*, including the question of responsibilities, the lack of clear leadership and fear of being dominated by other actors and losing control over development.

One example of uncertainty, hinted at earlier, concerned the roles that different actors were to assume in the processes of change. This uncertainty relates not only to the distribution of responsibilities between actors (which will be touched upon in the discussion on collaboration), but also to their perceived mandate, especially in the public sector. One example was a Swedish local government actor that at the time of the interviews was hesitant as to their mandate and role in relation to MaaS:

"We have ambitious sustainability goals in the municipality, and we see that integrated mobility services could play a part in fulfilling them … //… But what kind of possibilities or tools do we have to contribute to the development? That's a bit more difficult to see. That is, the role of the municipality in such a venture? … //… In any case, I have not seen how we [the municipality] could be a player in this." (ISE23 – public sector)

While uncertainty regarding roles relates to informal aspects such as self image, these roles will, sooner of later, become concretely expressed in more formal regulatory aspects on a meso level and they will also affect the propensity of private actors to invest. One example of how perceived institutional roles are related to regulations – and a key question to the private actors – was whether or not third-party actors will be permitted to sell public transport tickets (or not), as well as which types of tickets.

"… I'd say the tickets … //… [that the tickets] can be sold for all those modes of transport [that are] available … //… It's not a technical question, it's an organisational and legal question. Who is allowed to sell whose tickets, who is allowed to get certain discounts, that's sometimes quite complex when it comes to public transport … //… I think who is allowed to, to sell which tickets and under which conditions, I think that's the most important thing." (ISE12 - private sector)

Yet roles can also be related to the organisational culture of the respective organisations. Examples include a positive or negative attitude towards innovation and change, and willingness to participate in pilots or collaborative innovation. This culture can be related to the organisation's 'entrepreneurial mindset' (cf. Mukhtar-Landgren et al., 2016) and here public and private organisations may differ. For instance, a public transport organisation and their goals are largely designed for their traditional task, i.e. to manage the regional public transport system (in Finland and in Sweden), and not to innovate outside the traditional border of public transport. However, we also know that public actors can be innovative in different forms of experimental governance (Kronsell and Mukhtar-Landgren, 2018).

Another type of uncertainty concerned the viability of MaaS, a question raised by several informants, for instance whether or not MaaS actually provides a business opportunity; what the business potential of MaaS in fact is; and whether there are acceptable margins of profitability. MaaS was associated with high economic risks, huge marketing costs, a long return on investment and partners would have to share the business risk of the development, something which the informants found problematic, as the ecosystem would include both public and private actors. One such aspect that was prevalent in the cases and that has been noted in previous studies (e.g. Eckhardt et al., 2017; Kamargianni and Matyas, 2017; Sarasini et al., 2017) concerned the lack of appropriate business models; a central theme elevated by informants from both public and private organisations. Although various business models have been proposed (see e.g., König et al. 2016b), most informants agreed that new MaaS business models need to be developed that encompass novel and complex partnerships between multiple private and public sector actors, partnerships of which a majority of informants had no or very little previous experience. The informants' concerns involved how the business models could really 'fit' all involved actors, the scalability of the models, and how profits should be distributed.

"The Gordian knot is, I believe, the business model. That is the relation between the customer and the service provider, the broker and the one responsible for service content. [Creating] the triangular relationship in a way that makes sense from a business perspective – that will be difficult. That is the challenge." (ISE15 – public sector)

Other and related uncertainties concerned travellers' actual willingness and intention to adopt MaaS, as well as the types of

mobility services that should be included, and what prices the users/customers would be willing to pay. These described uncertainties were to a large extent rooted in the notion that there is a lack of 'proof of concept'. Thus, the informants emphasised the need to experiment in order to learn about for example travellers' behaviour. However, there were also those informants who believed in MaaS as a way to reach new customers and to increase the market share of the organisation.

> "What does [the PTA] want to achieve with these services? Well, to develop a service that is as useful as possible for the customer. … //… We should be able to reach new customers with this service – those we do not reach today. We have a goal of doubling the market share [for PT] and we think this type of service can help us achieve that goal." (ISE4 – public sector)

Again, these formal aspects of whether or not MaaS is a viable solution were also partly mediated through informal aspects. One example raised was a fear of losing one's own brand image as well as one's relation to the customers (cf. Smith et al., 2017).

> "Then we have brand, market and control. Well, they are … they are related. … //… It is our brand that will be 'named and shamed'. It is unavoidable." (ISE2 – public sector)

Taken together, the uncertainties have fostered some level of inertia in both public and private organisations. This is not least indicated by the fact that these types of uncertainties are clear barriers for collaboration, and the need for *cooperation* and *collaboration* was emphasised by informants in both countries. Both public and private actors underscored that, in order for collaboration to work, the roles and responsibilities of different actors have to be established, including which actor should lead the process. Yet another factor – also related to uncertainties on the business side – was the fear of being dominated by other actors and losing control, which might also hamper collaboration.

As mentioned earlier, the roles of different actors are still uncertain in the development of MaaS. This is also related to sensed incompatibilities between public and private goals, such as between public transport's goals of sustainable transport and the commercial goals of a MaaS business.

> "We may want to promote seasonal [public transport] tickets but a MaaS company might want to promote that person to start to use other and more expensive services. Then there is, I think, a conflict of interest." (IFI5 – public sector)
> "So, if we should have a sustainable society as a goal, then I believe that we must take part in [development] and influence it so that the development moves in this direction. It is not given that a commercial actor considers a sustainable society as the goal for the business. No, it must be society that still has the responsibility and see to that, that we move in that direction." (ISE4 – public actor)

In the interviews, these sensed conflicts, as well as uncertainties in terms of responsibilities, were described as central barriers to collaboration. Sometimes, they were also related to the lack of leadership and whether or not leadership should be left to the public, or to the private sector.

The question of leadership is fundamental to the development processes of MaaS. It has been suggested that public sector leadership can be crucial for the development and implementation of MaaS (Holmberg et al., 2016), yet the private sector may also be essential in order to develop innovative services. The empirical material revealed some ambivalence regarding who should be initiating and driving MaaS development. This was often related to the uncertainties mentioned earlier regarding what respective organisations' roles could or should be. In the interviews, arguments were raised for both public and private leadership. Those informants, both public and private, advocating that the public sector should take the major responsibility – i.e. that the public transport organisation should take lead and enlarge the public transport offering to include MaaS – forwarded various arguments for the public sector. One argument was the public transport organisation has access to tax money and that they would therefore be able to, at least initially, run the service in a non-commercial way and overcome what was mentioned as an important barrier – access to risk capital. This way the public sector could provide the financial stability to develop the service. Another argument forwarded was instead related to the importance of safe-guarding public goals:

> "I think the public transport operator is an important operator in this context and if we want to achieve what we want in relation to environmental goals and a higher share of public transport and get a higher market share for the benefit of public transport and reductions in car traffic, then I think we as a societal actor must take more responsibility than we do today." (ISE26 - public actor)

Those informants that insisted that the private sector must direct development forwarded different arguments against the public sector. Some of these referred to the public sector's lack of competence in the field.

> "I see this [MaaS] as a service that is best developed by private actors. … //… It is a bit difficult to see that it would be a public actor who is the driving force. … //… I do not really see that there is any public actor, where such an assignment would fit the area of competence." (ISE23 - public actor)

Another, related, argument referred to the public sector's slow decision processes:

> "If one takes a look at the [PTAs'] visions for the future, they have large projects and they talk a lot about developing apps, integrating new services, allowing new business models etc., but there is a long way between that vision and where they are today" (ISE24 – private actor)

Besides the lack of a clear division of responsibilities and leadership, collaborative efforts were also considered to be hampered by an underlying degree of suspicion or even fear of being dominated by other actors and of losing control over the development of MaaS.

"That's the biggest problem in transport, everybody thinks that we have to be in power. When I talk to the train-service monopoly they say; 'Yeah, we need to control the customer, we need to control this market, we need to control'. Look, you can't!" (IFI9 – private actor)

It was evident though that, particular in the interviews with public actors, that the fear of loss of control did not only entail a commercial actor in charge and potentially leading the development of MaaS but something more fundamental.

"It is really a very ideological or political question, and you can probably have very different opinions regarding [the role], whether you think that it's the market that should steer something like this, or if you think it's the public [sector] that should govern." (ISE4 – public actor)

4.3. Micro level

Both macro- and meso-level institutions have implications for the micro level and for the individual in her capacity as a potential customer/user of MaaS. This includes formal aspects, for example taxation of vehicles and congestion charges, as well as informal ones, such as societal trends in terms of environmental concerns and towards joint or shared ownership or no ownership at all, of for example a car. These trends have repeatedly been argued as creating opportunities for MaaS (e.g. Konig et al., 2016a).

As indicated in the framework, earlier research has shown that changing people's travel behaviour is difficult and a number of informal factors has been proposed as explanations including norms, attitudes, established habits, and the individual's perceived so-called 'action space', i.e. what individuals perceive as possible given the situation (Strömberg, 2015). The question in meso-level actors' minds as to travellers' attitudes, as well as willingness and intention, to become MaaS customers/users is therefore reasonable. (This question is shared by others within the transport community why several, primarily stated preference studies targeting potential users, have been conducted to help reduce this uncertainty including Hensher et al. (2017), Ho et al. (2017), Matyas and Kamargianni (2017), Ratilainen (2017).

The interviews reported here involved individuals who had decided to register as interested in participating in a MaaS pilot, more specifically the UbiGo pilot in Gothenburg. Overall, for most informants, an important reason to register was curiosity, often associated with underlying questions such as whether or not the household really needed a car (or a second one). Environmental concerns were also mentioned but it appeared as though this was not the decisive factor.

"We had difficulties getting a parking place. … //… It was more a practical solution to have at least one car less. The thought was to have one car less but still not be without a car. I can be honest and say that it was sort of: Can we get away with not having one car each?" (ISE9 – customer/user)

Among the informants who finally decided to *not* become pilot participants, one explanation was that they felt it would have required too much effort to learn how to use a new service – something that can be related to habits as a barrier. Other factors concerned, however, their assessment of the service attributes. This included for example the amount to pay and how to pay for the service. Some informants who declined becoming a customer/user argued that the cost would be higher than their present cost for travel, and for several the idea of subscribing – i.e. of paying for something in advance – was not acceptable.

"The paying in advance, that reduced the rating somewhat. I can understand that one must have a budget somehow, but this became too steered. … //… If the municipality is supporting this, one should have a high credit rating if the municipality is behind it all, then one (the company) could send the invoice and (the customer should) not have to pay in advance." (ISE17 – non-customer)

Another important reason, related to the service offer, was that it was not perceived to 'fit' the individual's or the household's need for transport. Some informants felt as though they were not part of the actual target group for the service and/or they did not recognise that the service offered any real benefits compared to how they presently solved their transport problems.

"I am for example a Coop member, and they have a deal with [a local taxi company], and they have an app and then you get a discount. So, if I need to take a taxi to the city centre, then I book a taxi via the app, very easy. And then I have cheaper (options) … the same thing with [a local carsharing company]. " (ISE15 – non-customer)

Several informants spoke about their need for flexibility and explained that even though the service included possibilities to subscribe to public transport, taxi, rental cars, car- and bikesharing, the service was not as flexible as they wished.

"I went to the information meeting and then I felt that it [the service] was not as flexible as I had expected. It appeared to me as though the service was designed as an offer for people with cars in order for them to get rid of their car. I had already done that so … //… but I felt as though one became locked in … in the way this service was designed. (ISE15 – non-customer)

For the individuals who did decide to become pilot participants/subscribers, the motive of curiosity soon faded and other factors related to the service design became increasingly important (see also Karlsson et al., 2016; Sochor et al., 2015). Interestingly, many of the features that the non-adopters claimed to discourage them from joining were described by the adopters as the reasons for joining. Hence, a decisive factor behind the decision to become a MaaS customer/user (or not) was whether (or not) the informants perceived a 'match' between their travel needs and the solution offered by the service (in terms of cost, transport modes, administrative routines, etc.).

”My travel habits needed this kind of solution. … //… This was something that I have been looking for … Everything in one, that is a perfect solution.” (ISE7 – customer/user)

The interviews revealed that cost also played a role for the adopters but one of the claimed benefits was that the subscription and monthly invoice meant that the household’s travel expenses became more transparent. Hence, the informants felt more in control of their expenses, which was considered an added value.

Whereas the service was not considered flexible enough by some non-adopters, the actual customers/users argued that the flexibility the service offered was a very important attribute for becoming a MaaS user. This flexibility concerned being able to easily change one’s subscription, and that ‘one-stop’ access to different transport modes facilitated access to and use of the whole transport system, better matching mode choice to each individual trip’s requirements. As users, they were not locked into any specific mode of transport, neither car nor public transport.

Yes, [the service] makes it easier than to purchase public transport tickets and get a carsharing membership and other such things, you can use the bicycles [bikesharing] and such. … //… that you paid for a daily public transport ticket instead of per month, or week, that you pay for what you use.” (ISE2– customer/user)

The micro-level analysis revealed that earlier mentioned informal factors in terms of norms, attitudes, etc. may have played a role in prompting an interest to *become* MaaS customers/users. Also, established habits and learning new habits may be a discouraging factor whereas, for example, difficulties accessing parking may be a factor which encourages a search for alternatives. However, what moreover became evident as a determining factor was how the informants assessed the benefits of the service offer relative to their specific situation. Note however that benefits of *remaining* a customer were not necessarily the same, and were often ‘discovered’ after the service had been tried out and used over a period of time (Sochor et al., 2014; Sochor et al., 2016). These assessments of the benefits – for both becoming and remaining a customer – included not only cost and the modes of transport but also other service-related factors, which together formed what can be described as the ‘S’ in MaaS.

5. General discussion and implications

The development and implementation of MaaS is a process embedded in institutional settings that are both formal and informal, and as such, requires institutional changes at many different levels, within (and between) different organisations. It also requires collaboration, both between actors and between different levels in the MaaS ecosystem. Furthermore, actors will be required to take on new roles in relation to each other, which might not come easily, depending on for example the organisational culture, but also on perceptions of oneself and others, political will, the existence of viable business models, etc. Taken together, the study has shown that development and implementation of MaaS are more complex than what might be first imagined.

Assuming MaaS is as a concept worthy of pursuit, the study presented here implies that, for MaaS development and implementation to take off, a common vision and roadmap are needed, where public and private actors share the risk inherent in investing in a new and unproven concept. The study also shows how political will is key to creating momentum for MaaS implementation, and provided that there is a political will to support MaaS, a number of formal adjustments are possible.

In several countries, the transport sector is heavily regulated, which constitutes a safeguard for public values, but might hamper innovation. A general conclusion is that for MaaS to develop, national policy needs to support MaaS and implement facilitative legislation. It is key to find the right level of regulation, whereby public interest is served and private actors find it easy enough to participate and innovate. In practice, this includes for instance changes in national tax legislation to induce demand for alternative mobility solutions. On a more detailed level, if transport legislation lags behind development and does not sufficiently cater for new phenomena such as carsharing, this can create small but substantial stumbling blocks for MaaS. In Sweden, for example the lack of a formal definition of carsharing in the legislation has made it difficult for local governments to designate parking for carsharing vehicles (cf. SOU, 2017:22), which could otherwise be a way to increase the attractiveness of carsharing. Nevertheless, as observed in the Finnish case, where major revisions have been made to the transport regulation with the purpose of smoothing the path for new MaaS solutions, implementation has still been rather slow, illustrating that legislation is clearly not the only stumbling block.

As the empirical analysis has shown, legislative aspects do not only pertain to formal legislative action space, but also to local and regional interpretations of regulations such as in the case of competition laws, i.e. the informal dimension of institutions. The informal dimension was also indicated by self-perceptions and roles. The active engagement of public transport is most probably a prerequisite for successful MaaS implementation. In Sweden, the current Swedish Public Transport Act creates no incentives for public transport to provide anything more than traditional public transport, and is experienced as restricting the possible action space for the regional public transport authorities in relation to MaaS. There is thus a need to rethink and redefine what public transport is in a way that could include new emerging solutions such as MaaS. Today, the understandings of MaaS within public transport range from MaaS being seen as a threat against the core business of PT, to MaaS being seen as the potential saviour of public transport.

However, the state (i.e. national level) is not the only policy making actor, and it is important to remember that political initiatives and policies can well originate *from* instead of being imposed *on* the regional or local level. As many political actors and levels are involved, no single actor can have the sole responsibility for creating a fertile ground for MaaS, and hence responsibility easily falls to no one, instead of to every one.

MaaS implementation requires funding. Funding could come from public or private actors, or most likely a combination. Public actors could be interested to contribute to establishing MaaS if the solutions being implemented contribute to societal goals, such as better accessibility, reduced congestion, or reduced carbon emissions. If such positive externalities can be created and valued, this

could have implications for how we think about potential business models for MaaS. Nevertheless before large-scale MaaS schemes have been implemented, the potential positive effects of MaaS are more or less hypothetical, which reduces the will to invest in such schemes and creates a deadlock. In both Sweden and Finland there is a belief in the potential of pilots as a means to gather more evidence, a belief that has also been followed up by funding opportunities. Field trials forming a step between demonstrations and full operation are necessary to foster learning and trust between actors, and can provide the evidence needed for participants to take the risk to scale up operations. Such trials could focus on technology, but more important is probably to experiment with service concepts and designs, collaborative models, or effects of different political policies such as parking regulations. Activities such as policy labs could be used to identify supportive policies, as well as to open up for a variety of stakeholders including citizen groups and local civil servants in processes of experimentation.

Other important measures to support MaaS could work more indirectly through increasing demand for alternative transport solutions. On the local level, municipalities could for example reduce the minimum parking requirements, not least in new developments with good accessibility to public transport, which would increase the relative attractiveness of other means of transport than the private car. On the national level, changes in tax legislation (such as the current Swedish rules allowing tax deductions for travelling to work by private car or advantageous rules about 'fringe benefit' cars) could similarly change the relative attractiveness of different modes of transport and create demand for new combined services.

In summary, MaaS is situated in the intersection of several institutional contexts as it ties into both policies and norms related to sustainability, personal transport and innovation. In practice such cross-sectorial characteristics entail that the development of MaaS may be topical in a number of different state agencies and authorities, as well as local and regional authorities, ranging from innovation agencies to transport agencies (cf. Mukhtar-Landgren and Smith, 2019), but it also indicates, as the analysis has shown, that responsibility could always be perceived as to lie 'somewhere else', and without a clear or self-evident leader.

The findings indicate that law-making authorities can facilitate MaaS developments by adjusting relevant regulations and policies such as transport-related subsidies, taxation policies and the definition of public transport. Regional and local authorities could additionally contribute to creating conducive conditions for MaaS by, for example, planning urban designs and transport infrastructures to support service-based travelling. Moreover, private actors have key roles to play in future MaaS developments, as both public and private transport services are needed if MaaS is to become a viable alternative to privately owned cars. Thus, the advance of business models for MaaS that benefit all involved actors is vital for the prosperity of the emerging MaaS ecosystem.

Finally, the reported research focused on Finland and Sweden, arguably two countries that have acted as forerunners in terms of MaaS developments, but also have many distinct characteristics that influence transport innovation and travel behaviours (among other things), and therefore set them apart from other countries in Europe and beyond. Compared to most other countries, both Finland and Sweden have well-off and educated populations, cold climates, large governments yet decentralised sub-national units, explicit sustainability goals, high levels of trust in the public sector, rich histories within digital innovation, and high penetration rates when it comes to internet and smart phone access. Moreover, the road transport infrastructure networks and public transport systems in Finland and Sweden are fairly large from a global viewpoint. Thus, the choice of research setting has several implications on how the developed analytical framework and the proposed implications can be applied to dissimilar contexts. For example, the interpretation of macro, meso and micro levels in this paper presupposes that most relevant regulations for transport, innovation and public administration sit with the national government. This is not the case in many federations, such as Australia, Canada and the United States, where the states have a large share of the regulatory power. Furthermore, the discussion on the potential roles of MaaS is based on the notion that MaaS will compete with private cars, which is not pertinent for the majority of the population in a number of countries, for example Ethiopia, Nepal and Bangladesh where less than one percent of the population owns a motor vehicle (World Bank, 2018). Moreover, the tentative conclusion that both public and private transport services are needed if MaaS should become a viable alternative to privately owned cars is based on the widely adopted assumption that publicly governed traditional (mass) public transport services should act as the spine of MaaS (e.g. UITP, 2014). Still, such systems are nonexistent or limited in many parts of the world. All in all, more studies in diverse contexts are needed to assess the usability of the analytical framework and the transferability of the findings. Beyond contextual differences, this also includes a call for studies of barriers and enabling factors in later phases of the development and implementation of MaaS.

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